

REMARKS

The Office Action dated October 23, 2006 has been received and carefully noted. The above amendments to the claims, and the following remarks, are submitted as a full and complete response thereto.

Claims 38-56, 71, and 74 have been amended to more particularly point out in distinctly claim the subject matter of the invention.

Applicants are grateful for the indication that claims 55 and 74 contain allowable subject matter, and would be allowable if amended to be in independent form. Accordingly, claims 55 and 74 are rewritten in independent form including the base claim from which they depend. Thus, it is respectfully submitted that claims 55 and 74 are reconditioned for allowance.

Claims 38-75 are respectfully submitted for consideration.

IN THE DRAWINGS:

On page 2 of the Office Action, FIG. 7(B) was objected to because the second output signal should be labeled as "210" Accordingly, please substitute the attached Replacement Sheets containing FIG. 3 for the original sheet of drawing filed in connection with the present application, as set forth above. The Examiner's approval of the attached Replacement Sheets is respectfully requested.

OBJECTIONS TO THE ABSTRACT:

The abstract has been reviewed in response to this Office Action. Changes have been made to the abstract only to place it in preferred and better U.S. form for issuance and to resolve the Examiner's objections raised in the Office Action. No new matter has been added. The Examiner's approval of the abstract is respectfully requested.

REJECTION UNDER 35 U.S.C. § 103:

On page 4 of the Office Action, claims 38-50, 52-53, 56-59, 71-72, and 75 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,304,618 to Hafeez et al. ("Hafeez") in view of U.S. Patent Publication No. 2002/0132600 to Rudrapatna ("Rudrapatna") and further in view of WO 2000/52845 to Cheong ("Cheong"). As will be discussed below, each of the presently pending claims recite subject matter which is neither disclosed nor suggested in Hafeez, Rudrapatna, and Cheong.

Independent claim 38, upon which claims 39-46 and 53 are dependent, is directed to an apparatus, including a plurality of receiving elements each of which is configured to receive a composite signal including at least some of a plurality of signals. The apparatus receives the plurality of signals at the same time. A processor is configured to receive the plurality of receiving elements composite signal, and to provide an estimate of at least two of plurality of signals. The processor is configured to provide an estimate of a first

one of the signals and to provide an estimate of a second one of the signals. The processor is configured, for each already determined estimate, to extend the estimate with a plurality of potential values. The estimate of second one of the signals takes into account the estimate of the first signal and the estimate of the first signal is modified in dependence on the estimate of the second signal.

Independent claim 52 is directed to an apparatus, including a plurality of receiving elements each of which is configured to receive a composite signal including at least some of a plurality of signals. The apparatus receives the plurality of signals at the same time. A processor is configured to receive the plurality of receiving elements composite signal, and to provide an estimate of at least two of plurality of signals. The processor is configured to provide an estimate of a first one of the signals and to provide an estimate of a second one of the signals. The processor is configured, for each already determined estimate, to extend the estimate with a plurality of potential values. The estimate of second one of the signals takes into account the estimate of the first signal and the estimate of the first signal is modified in dependence on the estimate of the second signal. A metric is determined for the extended estimates. The metric is calculated for a signal estimate at least partially from metric values stored during the calculation of a previously determined estimate

Independent claim 57, upon which claims 58-70 are dependent, is directed to a method including receiving a plurality of signals at the same time, receiving at each of a plurality of receiving elements a composite signal including at least some of the plurality

of signals, and processing the composite signal of each of the received plurality of receiving elements to provide an estimate of at least two of the plurality of signals. The processing includes providing an estimate of a first one of the signals and providing an estimate of a second one of the signals wherein during the processing, and extending, for each already determined estimate, the estimate with a plurality of potential values. The estimate of the second one of the signals takes into account the estimate of the first signal and the estimate of the first signal modified in dependence on the estimate of the second signal.

Independent claim 71 is directed to a method including receiving a plurality of signals at the same time, receiving at each of a plurality of receiving elements a composite signal including at least some of the plurality of signals, and processing the composite signal of each of the received plurality of receiving elements to provide an estimate of at least two of the plurality of signals. The processing includes providing an estimate of a first one of the signals and providing an estimate of a second one of the signals wherein during the processing, and extending, for each already determined estimate, the estimate with a plurality of potential values. The estimate of the second one of the signals takes into account the estimate of the first signal and the estimate of the first signal modified in dependence on the estimate of the second signal. A metric is determined for the extended estimates and the metric is calculated for a signal estimate at least partially from metric values stored during the calculation of a previously determined estimate.

Independent claim 75 recites an apparatus, including plurality of receiving element means each for receiving a composite signal including at least some of a plurality of signals, wherein the apparatus receives the plurality of signals at the same time, and processing means for receiving the plurality of receiving element composite signal and providing an estimate of at least two of the plurality of signals, the processing means providing an estimate of a first one of the signals and providing an estimate of a second one of the signals, wherein the processing means, for each already determined estimate, for extending the estimate with a plurality of potential values. The estimate of the second one of the signals takes into account the estimate of the first signal and the estimate of the first signal modified in dependence on the estimate of the second signal.

As a result of the claimed configuration of elements, embodiments of the present invention can maximize performance yet minimize complexity in reception of a composite signal. As will be discussed below, Hafeez, Rudrapatna, and Cheong fail to disclose or suggest the elements of the claimed invention, and therefore fails to provide the advantages thereof.

Hafeez generally describes a system within which a plurality of timings are estimated for received signal wherein the plurality of timings correspond to a plurality of transmitted signals. See column 2, line 16, to column 3, line 55. The received signal is then sampled in accordance with the plurality of timings to produce a plurality of sample streams from the single received signal. Channel estimates are then produced for the

received signals and metrics are computed using the sample streams and the channel estimates.

Hafeez describes, for example in column 4, lines 25-35, that multiple antennas may be used. Furthermore, Hafeez also describes determining a metric to order to use the joint maximum likelihood sequence to produce estimates of the first and second signals based on the sample of the correlation function. As described in column 6 of Hafeez, the metric is determined using a recursively process using the metric from the time and the previous time.

However, Hafeez is devoid of any teaching or suggestion of, at least, “wherein said estimate of said second one of said signals takes into account the estimate of the first signal and the estimate of the first signal is modified in dependence on the estimate of the second signal,” as recited in independent claim 38. Furthermore, Hafeez does not teach or suggest that the apparatus receives a plurality of signals at the same time as recited in independent claim 38. As correctly noted in the Office Action, independent claim 38 is therefore novel over Hafeez.

Additionally with respect to independent claim 52, there is no teaching or suggestion in Hafeez of at least, “wherein a metric is determined for the extended estimates and wherein said metric is calculated for a signal estimate at least partially from metric values stored during the calculation of a previously determined estimate.” This previously determined estimate being of the same time instant for the received signal. Therefore, independent claim 52, as amended, is novel for at least similar the reasons as

those provided supporting the patentability of independent claim 38, but additionally for the determination and calculation of the metric.

Therefore, Hafeez is deficient, at least, in that it is not flexible enough to receive multiple signals using multiple antennas as it is only used to clear-up errors by producing a continuous response information for the channel using time delayed information.

Referring to Rudrapatna, this reference generally describes an antenna array which has at least two groups of antennas wherein each group of antenna as at least two pairs of antennas as the pairs contain orthogonally polarized antennas which can be selected between.

Although Rudrapatna appears to describe to the person skilled in the art that a plurality of antennas are known, the person skilled in the art would not have been motivated to combine Hafeez and Rudrapatna as these references do not provide the person skilled in the art with the solution to the problem of reducing the complexity of receiving multiple signals over multiple antennas where “said estimate of said second one of said signals takes into account the estimate of the first signal and the estimate of the first signal is modified in dependence on the estimate of the second signal,” as recited in independent claims 38 and 52 and that “a metric is determined for the extended estimates and wherein said metric is calculated for a signal estimate at least partially from metric values stored during the calculation of a previously determined estimate,” as further recited in independent claim 52.

Cheong generally describes an iterative multi-user detection system. A fundamental purpose of Cheong is to reduce the impact of cross talk interference in multi-carrier data transmission systems. Cheong discloses receiving an input signal which includes a primary data signal and a superimposed cross talk signal which is received on a single wire or fixed line. Cheong discusses the configurations thereof as being a signal input/single output system, which can remove cross talk which can occur due to reflections during multiplexing or demultiplexing across an asynchronous digital subscriber line (ADSL). However, a person of ordinary skill in the art would understand that there is no disclosure or suggestion in Cheong of a plurality of receiving elements configured to receive a composite signal. The Office Action seems to take the position that decoder 700 and decoder 702 of Cheong are comparable to receiving elements according to the Applicant's claims. However, the description of Cheong clearly shows only a single receiving element, refer to as "Y," from which the received signal is then split to be input into the two decoders, decoder 700 and decoder 702. Referring to Fig. 6 of Cheong, it can clearly be seen that receiver 604 only has one input thereto. It is therefore, inappropriate to interpret Cheong as either disclosing or suggesting the claimed invention.

In other words, Cheong teaches a method where, within the receiver, the correct signal and each suspected interference signal requires a separate decoder. The output of each decoder is disclosed as being fed back to the input of other decoders. Therefore, in Cheong, each decoder attempts to produce a signal estimate, which can then be fed back

to the other decoders so that the decoder associated with the correct signal can be more accurately determined, after allowing the suspected interference signal values transmitted at the same time. A person skill in the art would understand that Cheong discloses a hardware “brute force” approach to determine the correct signal. A configuration according to Cheong may be effective in cases such as that which is disclosed in the description thereof, where the number of suspected interference signals is relatively small. However, it would be impractical to use the teachings of Cheong in a configuration where numerous signals are received for numerous receiver elements, due to the significant and inefficient hardware requirements. For example, multiple input multiple output (MIMO) systems would be an environment where Cheong would be unsuitable. There is simply no disclosure or suggestion in Cheong of a plurality of receiving elements each of which is configured to receive a composite signal including at least some of a plurality of signals, wherein the receiver receives a plurality of signals at the same time. Cheong, therefore, fails to disclose or suggest a processor as recited in the presently pending claims, which is configured to provide an estimate of a first one of the signals and an estimate of a second one of the signals, as well as the other limitations of the present claims.

Additionally, the Supreme Court in its recent decision in *KSR Int'l Co. vs. Teleflex, Inc.*, reiterated the Federal Circuit's instructions, In re Kahn, 441 F. 3d 977, 988, (Fed. Cir. 2006) that “rejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some

rational underpinning to support the legal conclusion of obviousness.” *KSR*, slip op. at 14. In this case the rejection lacks articulated reasoning with rational underpinnings that support the legal conclusion of obviousness, and, thus, the rejection should be withdrawn.

That the rejection lacks articulated reasoning with rational underpinnings for the proposed modification can be seen from the fact that the Office Action’s explanation for the alleged motivation is derived from a speculative scenario (Office Action, page 6), based on an incentive not evidenced to be within the knowledge of one of ordinary skill in the art nor in any of the cited references.

Thus, there would be no incentive for the person skilled in the art to combine Hafeez, Rudrapatna, and Cheong together, as the solution would not be provided by such a combination.

Furthermore, Hafeez and Rudrapatna are references associated with wireless communications systems. However, Cheong is associated with a wired communications system. Therefore, a person skilled in the art would not necessarily, when presented with the descriptions of Hafeez and Rudrapatna and a wireless communications system, look to a solution to the problem within a ADSL document.

Applicant respectfully submits that in order to combine the references, the Office Action is using hindsight analysis in selecting the references to attempt to arrive at the claimed invention. The mere fact that the prior art may be modified in the manner suggested by the Office Action does not make the modification obvious unless the prior art suggested the desirability of the modification. This approach where documents are

placed together in a patchwork arrangement would not lead to the present invention being obvious over the descriptions provided in Hafeez, Rudrapatna, and Cheong at the time of that the invention was made, at least for the reasons given above. There would have been no incentive for the skilled person to have combined the documents in the way suggested in the Office Action. Even if Hafeez, Rudrapatna, and Cheong are combined, a combination thereof would still not be no disclosure of all of the features of the invention. Consequently, it is respectfully submitted that, *prima facie*, independent claim 1 is both novel and non-obvious over the prior art.

It is therefore respectfully submitted that each of claims 38-50, 52-53, 56-59, 71-72, and 75 recites subject matter which is neither disclosed nor suggested in Cheong.

On page 11 of the Office Action, claims 51 and 70 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Hafeez, Rudrapatna, and Cheong, and further in view of U.S. Patent No. 4,980,897 to Decker et al. (“Decker”). Applicant respectfully submits, however, that each of claims 51 and 70 recites subject matter which is neither disclosed nor suggested in Hafeez, Rudrapatna, Cheong and/or Decker, when viewed either singularly or in combination.

Claim 51 and 70 are dependent upon claims 38 and 57, respectively. As discussed above, Hafeez, Rudrapatna, and Cheong fail to disclose or suggest the subject matter of independent claims 38 and 57.

Decker discloses a multi-channel trellis encoder/decoder. However, neither Hafeez, Rudrapatna, Cheong, nor Decker, when viewed either singularly or when combined in any way, discloses or suggests a receiver as recited in claim 38. The prior art fails to disclose or suggest “wherein said estimate of said second one of said signals takes into account the estimate of the first signal and the estimate of the first signal is modified in dependence on the estimate of the second signal,” as recited in independent claim 38 and similarly recited in independent claim 57.

There is simply no disclosure nor suggestion, in Hafeez, Rudrapatna, Cheong, and Decker of a configuration recited in the presently pending claims. These significant distinctions, therefore, are more than sufficient to render the claimed invention unobvious to person of ordinary skilled in the art. It is respectfully requested that independent claims 38 and 57 and related dependent claims 51 and 70 be allowed.

On page 12 of the Office Action, claims 54 and 73 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Hafeez, Rudrapatna, Cheong, and U.S. Publication No. 2002/0006122 to Zeira (“Zeira”).

Applicant respectfully submits, however, the each of claims 54 and 73 recites subject matter which is neither disclosed nor suggested in Hafeez, Rudrapatna, Cheong and/or Zeira, when viewed either singularly or in combination.

Claim 54 and 73 are dependent upon claims 38 and 71, respectively. As discussed above, Hafeez, Rudrapatna, and Cheong fail to disclose or suggest the subject matter of independent claims 38 and 71.

Zeira discloses channel estimation for time division duplex communication systems. However, neither Hafeez, Rudrapatna, Cheong, nor Zeira, when viewed either singularly or when combined in any way, discloses or suggests a receiver as recited in claim 38. The prior art fails to disclose or suggest “wherein said estimate of said second one of said signals takes into account the estimate of the first signal and the estimate of the first signal is modified in dependence on the estimate of the second signal,” as recited in independent claim 38 and similarly recited in independent claim 71.

There is simply no disclosure nor suggestion, in Hafeez, Rudrapatna, Cheong, and Zeira of a configuration recited in the presently pending claims. These significant distinctions, therefore, are more than sufficient to render the claimed invention unobvious to person of ordinary skilled in the art. It is respectfully requested that independent claims 38 and 71 and related dependent claims 54 and 73 be allowed.

CONCLUSION:

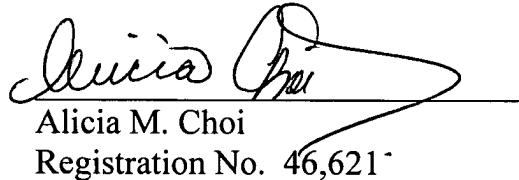
In view of the above, Applicant respectfully submits that the claimed invention recites subject matter which is neither disclosed nor suggested in the cited prior art. Applicant further submits that the subject matter is more than sufficient to render the claimed invention unobvious to a person of skill in the art. Applicant therefore

respectfully requests that each of claims 38-54, 56-73, and 75 be found allowable and, along with allowed claims 55 and 74, this application passed to issue.

If for any reason the Examiner determines that the application is not now in condition for allowance, it is respectfully requested that the Examiner contact, by telephone, the applicant's undersigned attorney at the indicated telephone number to arrange for an interview to expedite the disposition of this application.

In the event this paper is not being timely filed, the Applicant respectfully petitions for an appropriate extension of time. Any fees for such an extension together with any additional fees may be charged to Counsel's Deposit Account 50-2222.

Respectfully submitted,



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Enclosures: Additional Claim Fee Transmittal;
Replacement Sheet of FIG. 3;
Request for Continued Examination (RCE);
Petition for Extension of Time (3 Mo.); and
Check No.

IN THE DRAWINGS:

Pursuant to the enclosed separate Replacement Sheet, amendment to FIG. 3 is respectfully requested.